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HS-620/630 Vibration Meter Kit Operating Manual

Hansford Sensors Ltd.

December 2012

The HS-620 Vibration Meter Kit is an ideal low cost entry level vibration monitoring instrument, designed for Maintenance Technicians to use on site, helping to give protection to important plant machinery. The HS-630 adds an easy to use temperature measurement function.

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1. Overview

The HS-620 Vibration Meter Kit is a reliable and easy to use hand-held machine condition inspection instrument. It provides vibration measurement, alarm indication and a bearing status check facility. The HS-630 kit provides an additional facility for non-contact temperature measurement. The meter enables plant maintenance technicians to monitor their machines, find potential problems in advance of failure, and to ensure machine reliability.

1.1 HS-620/630 Kit Contents

VBA 20/VBA30 meter unit with lithium battery fitted
Hand Held Accelerometer with TNC Connector
80cm cable with TNC to BNC connectors
Magnetic Base
Vibration Spike
2 x Battery Charger (Mains +Car)
Manual
Carrying Case

1.2 Overall Vibration Mode

The meter can measure vibration Velocity in mm/s rms, Acceleration in g peak, and Displacement in μm peak to peak. When measuring Velocity, and on switching to the 'Hold' mode, the meter display will indicate an alarm status according to ISO10816-3.

1.3 Bearing Status Mode

The meter measures Bg value in g rms and Bv value in mm/s rms which represent the bearing status. The lower frequency machine vibrations are attenuated by a 1kHz high pass filter. In the 'Hold' mode, the meter display indicates the bearing alarm status.

1.4 Measurement Units

The meters are available in three different configurations for measurement units. These are: Metric 1, Metric 2 and Imperial. The units required must be specified on order – see table on page 5 for units used in each mode. Metric 1 settings are used throughout the manual.

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CERTIFICATE OF CALIBRATION

We certify that this product has been tested in accordance with our manufacturing procedures, using calibrated equipment traceable to UK national standards, to ensure that the product meets the published specifications.

Model No. HS-620/630 Serial No. _____

Calibrated By _____ Date of Calibration _____

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2. Operating Instructions



Figure 1. The VBA20

2.1 Sensor Connection

Fit the vibration sensor to the machine measurement position via a magnetic base or stud. Connect the sensor cable to the BNC connector on the meter. When a satisfactory sensor connection is made, the sensor fault icon on the LCD display will disappear. Conversely, the sensor fault icon will appear if the meter detects a poor sensor connection.

2.2 Power On/Off

Power On - Push **SEL** key only for ½ sec. The meter defaults to the overall vibration velocity range.

Power Off - Push two keys, **SEL + BRG** or **SEL + VIB** for 1 sec.

The meter will power-off on release of the keys.

The meter will automatically power-off after 3 minutes of no key operation.

2.3 Key Functions

SEL key- Press **SEL** to switch-on the meter.

In the Overall Vibration mode press **SEL** to toggle through the measurement parameter options:-

Table 1

OVERALL VIBRATION MODE	Measurement units – specified on order		
	Metric 1	Metric2	Imperial
Vel = Vibration velocity	mm/sec rms	mm/sec rms	in/sec rms
Acc = Acceleration	g pk	m/sec ² pk	g pk
Disp = Displacement	µm pk-pk	µm pk-pk	mil pk-pk

Table 2

BEARING STATUS MODE	Measurement units – specified on order		
	Metric 1	Metric2	Imperial
Bg	g rms	m/sec ² rms	g rms
Bv	m/sec rms	mm/sec rms	in/sec rms

VIB key - Press **VIB** to toggle between Measure and Hold modes. The Hold mode is indicated by an 'H' in the display.

In the BRG mode Press **VIB** to enter the Overall Vib. mode.

BRG key - In the Overall Vib. mode press **BRG** to enter the Bearing Status mode.

In the Bearing Status measurement mode press **BRG** to toggle between this and the Bearing Status Hold mode indicated by an 'H' on the display.

When the overall velocity reading is in the Hold mode, the meter display indicates the vibration alarm status of the machine according to ISO10816-3 as defined in section 3.

When the BRG velocity or g reading is in the Hold mode the meter display indicates the bearing status according to a rule-of-thumb assessment as defined in section 4.

7 . Warranty

All goods are guaranteed against defects in materials and workmanship, subject to specific exclusions, for a period of 36 months from the date of purchase. In the event of failure within 36 months of original purchase, the company will promptly repair or replace the defective components without charge.

Specific exceptions rendering the Warranty void are:-

If repair is attempted by unauthorised persons or agents, or if the product has been used for purposes for which it was not intended and or subjected to abuse or wilful neglect. No liability can be accepted for loss of items or component parts. It is expected that the user takes sufficient precautions to safeguard all guaranteed items.

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6. Specifications

Input	Constant Current Accelerometer 100mV/g
Vibration	Acceleration: 0-20gPk, Frequency Range 5Hz-12kHz Velocity: 0-200mm/s RMS, Freq. Range 10Hz-1kHz Automatic Alarm Check: ISO10816-3. Displacement: 0-2000µm Peak-Peak, Freq. Range 5Hz-1kHz
Bearing	Bg: 0-20 g RMS Freq. Range 1kHz -12 kHz Applies to Bg line & Bv line. Bv: 0-200 mm/s RMS, Freq. Range 1kHz-12 kHz Automatic Alarm Check for BG and BV: Rule-of-thumb
Temp. Range	-20°C to 120°C or -5°F to +250°F (HS-630 only)
Laser Guide	Red, λ=650nm <1mW, IEC 60825-1 compliant (HS-630 only)
Distance Range	For Temp. measurement 0 to 2 metres (HS-630)
Accuracy	+/-5%
Display :	LCD
Power	Lithium rechargeable battery, 3.6V 1700 mAh, Recharge time 3 hours, >48 hours continuous operation
Temperature	Operation: -10°C to +50°C; Storage: -20°C to +60°C
Meter Sealing	IP54
Spike Length	75mm
Magnetic Base	Diameter 25mm, H 17mm, pull strength 12Kg
Meter Size	L 115mm x W 70mm x D 25mm
Carry Case Size ...	W 342mm x D 265mm x H 80mm
Weight	Full kit including carry case 1.25 Kgs
Cable Length	0.8m (other lengths available)

2.4 Overall Vibration Measurement & Assessment

At switch-on the meter defaults to the Velocity measurement mode, with the units 'mm/s rms' indicated at the bottom right of the display.

If required, press **SEL** to select acceleration or displacement. Note that no vibration assessment is available on these ranges.

When the vibration reading has settled, press **VIB** to move to the Hold mode. An 'H' icon is displayed.

In the velocity range the meter will then indicate either a tick icon for **OK**, a single bell for vibration alert or two bells for danger.

The meter makes this assessment depending on the vibration level and one of the four machine group options selected using the **SEL** key.

The machine groups are defined in ISO10816-3 and the meter categorises these as 'ISO1&3-R', 'ISO1&3-F', 'ISO2&4-R', 'ISO2&4-F'. R and F refer to rigid and flexible machine mounting respectively.

A label on the back of the meter gives details of the ISO10816-3 machine groups. The user can refer to this to confirm the appropriate group number for the tested machine. The information contained is as follows in section 2.5.

2.5 ISO Machine Groups:

Group 1 – Large machines rated power above 300KW; Electrical machines with shaft dia. >315mm. Normally sleeve bearings, speed 120RPM - 15000RPM.

Group 2 – Medium size machines rated power 15KW < P < 300KW; Electrical machines with shaft 160mm < dia. > 315mm. Normally element bearings, Speed above 600RPM.

Group 3 – Pumps with multi-vane impeller and with separate driver (centrifugal, mixed flow or axial flow) with rated power above 15KW.

Group 4 – Pumps with multi-vane impeller and with integrated driver (centrifugal, mixed flow or axial flow) with rated power above 15KW.

Support Class: **R** = Rigid Mount: **F** = Flexible Mount.

2.6 Bearing Status Check

Fix the sensor directly to the bearing housing as close to the bearing as possible. Note that valid high frequency readings are unlikely to be measured using hand pressure and the spike.

Press the **BRG** key to enter the **Bearing Status** mode.

Press the **SEL** key to select either Bg (g RMS) or Bv (mm/s RMS).

When the bearing status reading has settled, press the **BRG** key to enter the hold mode (**H**). The bearing status reading is then held and the rule-of-thumb alarm status displayed.

Press the **SEL** key to toggle through and select the appropriate speed range of the bearing shaft. (rpm:<500, rpm:<1000, rpm:<2000, rpm:<5000, rpm:<10000) .

The meter will then indicate either a tick icon for **OK**, a single bell for vibration **alert** or two bells for **danger**.
The meter makes the assessment based on the rules-of-thumb defined in section 4

2.7 Battery & Charger

The Vibration Meter is powered by an internal rechargeable Lithium-Ion battery which can operate for 48 hours continuously following full charge. The battery condition is indicated by an icon at the top right of the meter display.

The battery charger supplied requires 3 hours to fully charge the battery. An LED on the charger indicates the charge status, being orange when charging and green when charging is complete.

5.1. Surface Temperature Measurement

The temperature sensor measures the average temperature in a circle of diameter one-eighth of the distance between the surface and the sensor. For example, when the meter is held 1m from a surface, the sensor will respond to a 125mm spot diameter on the surface. Thus, the measuring distance will define the size surface to be measured. The maximum recommended distance from surface to sensor is 2m and hence the maximum spot diameter is 250mm. The measurement is made as follows:-

Switch on the meter using the **SEL** key

Press the **F/°C** for the temperature mode

Aim the laser beam at the surface to be measured at a suitable distance from the surface, remembering that the temperature sensor spot diameter is one-eighth of the distance (ie not the laser spot size).

The temperature reading can be toggled between °F and °C using the **SEL** key. Ambient temperature is indicated at the bottom left of the display.

Exit the temperature mode by pressing the **Vib** or **Brg** key.

4.2 BV Values

Bv measurement is a long established method for detecting bearing faults which gives reliable indication of bearing condition in 80-90% of cases. The rule-of-thumb assessment used in the meter is as follows:-

- $BV \leq 1\text{mm/s}$ - Healthy bearing, correctly greased
- $BV \approx 1\text{--}2\text{mm/s}$ - Possibly damaged or un-greased bearing
- $BV > 2\text{mm/s}$ - Bearing seizure likely

5 - Temperature Mode (HS-630 only)

The HS-630 uses a thermopile infra-red sensor to indicate temperature in Deg.C or Deg.F on the display. An alignment laser beam is provided to indicate the area where the temperature is being measured. Ambient temperature is also indicated in the bottom left of the display.

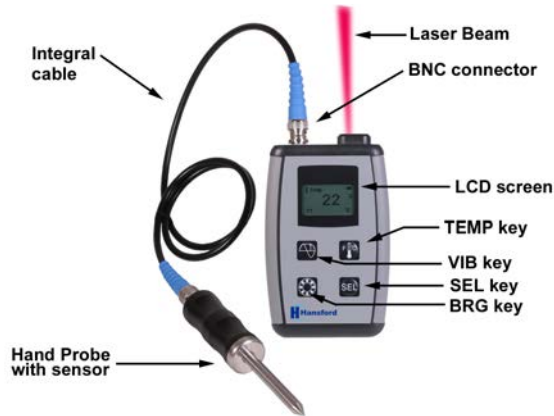


Fig.4. HS-630



Caution – Laser radiation - Do not stare into the Laser beam.

3. The ISO10816-3 Machine Vibration Standard

Industrial machines covered by the ISO10816-3 standard include :-

- Steam turbines with nominal power less than 50MW
- Steam turbines with nominal power above 50MW with speeds less than 1500rpm or above 3600rpm (ie. excludes machines included in ISO10816-2)
- Rotating compressors
- Industry gas turbines with nominal power less than 3MW
- Centrifugal, Mixed flow, or Axial flow pumps
- Electric Generators excluding Hydro-electric or pump stations
- Electrical motors of all types
- Blowers or fans

The standard classifies machine groups as in section 2.5 and defines vibration levels for each group, shown in the chart on page 9, as follows:-

Green – levels expected for a new machine.

Yellow - levels considered as acceptable for long periods.

Amber - levels not acceptable for long periods.

Red – levels likely to cause machine damage.

It further classifies machines as being either rigid or flexible mounted with the flexible mounted machines being allowed higher vibration levels. The meter indicates a tick box for levels in the green and yellow sections and uses the lower limit for the amber sections and the red sections in its vibration assessment.

Industrial machines with power above 15kW and nominal speeds between 120 -15000 r/min				
Unit	Group 1 and 3		Group 2 and 4	
mm/s	Rigid	Flexible	Rigid	Flexible
0-1.4				
1.4-2.3				
2.3-2.8				
2.8-3.5				
3.5-4.5				
4.5-7.1				
7.1-11				
11--				

Fig.2 ISO 10816-3 Vibration Levels

The machine mountings affect the resonances related to the basic running speed of the machine. Machines with rubber or spring mountings often vibrate at low speeds following start-up, and as the speed increases the vibration level is reduced. Such a machine is considered to be flexible mounted.

Modern high speed machines having flexible bearing supports can also be considered as flexible mounted even though not mounted on rubber or springs.

A great advantage of using proper vibration measurements and standards is that future maintenance requirements and costs can be assessed reliably on machine commissioning. For example, if levels of 3mm/s rms are measured for a new machine, it is likely to require high maintenance activity. The specific requirement of this is dependant on the machine design and the advice of the machine manufacturer should be sought.

4. Bearing Status Assessment

When the rolling elements move inside a bearing, broadband noise and vibration is generated. This increases if the bearing is not properly lubricated, or is overloaded due to misalignment or damaged surfaces. The bearing vibration Bg or Bv measured by the meter is the RMS value of all high frequency bearing vibrations between 1kHz and 12KHz.

The vibrations below 1kHz are suppressed in the Bg and Bv modes to eliminate the measurement vibrations caused by imbalance or misalignment. A practical problem arises in gearboxes, and other machines where steel meets steel, in which vibrations are produced in the same frequency range as the bearing vibrations. For this reason bearings should not normally be exchanged on the basis of a high bearing value only. A high bearing condition value is an indication that further analysis is required, and an FFT analyser will indicate if there are frequencies corresponding to the calculated bearing frequencies.

4.1 Bg Value

Bg value is vibration acceleration within 1-12kHz in units of g RMS. The reason for using acceleration is that it gives larger values at higher frequency than velocity measurement. The rule-of-thumb assessment of Bg is shown in the chart on page 10.

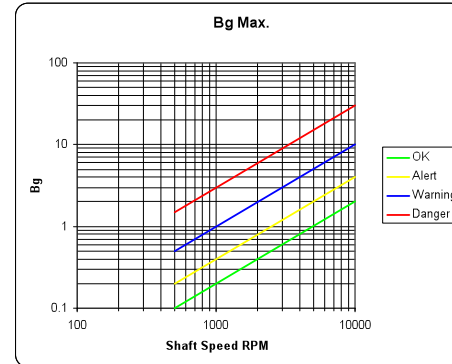


Fig.3. Bg Levels